Sampling Distributions Checkpoint 1

Question (1)

In June 2005, a survey was conducted in which a random sample of 1,464 U.S. adults was asked the following question: "In 1973 the Roe versus Wade decision established a woman's constitutional right to an abortion, at least in the first three months of pregnancy. Would you like to see the Supreme Court completely overturn its Roe versus Wade decision, or not?"

The results were: Yes—30%, No—63%, Unsure—7% (*Source*: www.Pollingreport.com)

Which of the following is true?

A: 30%, 63%, and 7% are all parameters.
B: 30%, 63%, and 7% are all statistics.
C: If another random sample of size 1,464 U.S. adults were to be chosen, we would expect to get the exact same distribution of answers.
D: Both (A) and (C) are correct.
E: Both (B) and (C) are correct.

Feedback

A : 0

✗ This is not quite right. When discussing parameters, we are referring to the actual value of certain variables relating to the population. In this example, if we were able to poll all U.S. adults and have everyone respond to the poll, then these numbers would be parameters. Consider the remaining options. (B) is the right answer.

B : 10

Good job! Since the survey results are obtained from the sample, these are all statistics. Due to sampling variability, if we were to take a different sample of the same size we would not expect to get the same sample results.

C : 0

This is not quite right. Due to sampling variability, we cannot expect to get the same sample results from multiple samples. Consider the remaining options. (B) is the right answer.

D : 0

This is not quite right. When discussing parameters, we are referring to the actual value of certain variables relating to the population. In this example, if we were able to poll all U.S. adults and have everyone respond to the poll, then these numbers would be parameters. Also, due to sampling variability, we cannot expect to get the same results from multiple samples. Consider the remaining options. (B) is the right answer.

E : 0

This is not quite right. Due to sampling variability, we cannot expect to get the same sample results from multiple samples. Consider the remaining options. (B) is the right answer.

The next three questions refer to the following information:

A social scientist wishes to conduct a survey. She plans to ask a yes/no question to a random sample from the U.S. adult population. One proposal is to select 100 people; another proposal is to select 900 people.

Question (2)

Which of the following is true regarding the sample proportion p-hat, of "yes" responses?

A: The sample proportion from the sample of 900 is more likely to be close to the true population proportion, p.

B: The sample proportion from sample of 100 is more likely to be close to the true population proportion, p.

C: The sample proportion in either proposal is equally likely to be close to the true population proportion, p, since the sampling is random.

D: It is impossible to say one way or the other.

Feedback

A : 10

✔ Good job! The larger the sample size, the closer we expect the sample proportion to be to the true population proportion. Intuitively, this makes sense, since the larger the sample, the more it is â€œlike the population.â€ More formally, since the standard deviation of the sampling distribution of the sample proportion p-hat is: p (1 − p) n , it decreases as the sample size increases. This means that for larger sample sizes, the possible values of p-hat are less spread out and therefore more likely to be closer to their mean, which is the population proportion, p.

B : 0

✘ This is not quite right. Remember that the standard deviation of the sampling distribution of p-hat is p (1 − p) n , which clearly decreases as the sample size increases. This means that a statistic, p-hat, will have a higher probability of being closer to the true population proportion, p, with a larger sample size. Consider the remaining options. (A) is the right answer.

C : 0

✘ This is not quite right. Remember that the standard deviation of the sampling distribution of p-hat is p (1 − p) n , which clearly decreases as the sample size increases. This means that a statistic, p-hat, will have a higher probability of being closer to the true population proportion, p, with a larger sample size. Consider the remaining options. (A) is the right answer.

D : 0

✘ This is not quite right. It may be helpful to go back and re-read the section on sampling distributions. Then consider the remaining options. (A) is the right answer.

Question (3)

If the study were conducted over and over (selecting different samples of people each time), which one of the following would be true regarding the resulting sample proportions of "yes" responses?

A: Different sample proportions would result each time, but for sample size 900 they would be centered (have their mean) at the true population proportion, whereas for sample size 100 they would not.

B: Different sample proportions would result each time, but for sample size 100 they would be centered (have their mean) at the true population proportion, whereas for sample size 900 they would not.

C: Different sample proportions would result each time, but for either sample size, they would be centered (have their mean) at the true population proportion.

D: For either sample size, using the same size each time, as long as the sampling is done ***with replacement***, their mean would be 0.

E: None of the above is true, since it makes no sense to talk about the ***mean*** of sample proportions.

Feedback

A : 0

✗ This is not quite right. Remember that the sampling distribution of p-hat will be normally distributed with a mean of p, the population proportion. Consider the remaining options. (C) is the right answer.

B : 0

✗ This is not quite right. Remember that the sampling distribution of p-hat will be normally distributed with a mean of p, the population proportion. Consider the remaining options. (C) is the right answer.

C : 10

✓ Good job! Due to sampling variability, for different samples we will get different values of p-hat. Since the mean of the sampling distribution of p-hat is p, the population proportion, whether we take a sample of size 100 or a sample of size 900, the resulting values of p-hat will be centered around p in both cases.

D : 0

This is not quite right. Remember that the sampling distribution of p-hat will be normally distributed with mean p, the population proportion. Because the sampling distribution is normally distributed, and p-hat cannot take on negative values, it doesnâ€™t make sense to have the sampling distribution centered at 0. Consider the remaining options. (C) is the right answer.

E : 0

This is not quite right. It may be helpful to review the pages on sampling distributions and then consider the remaining options. (C) is the right answer.

Question (4)

Which one of the following is true regarding the standard deviation of the sampling distribution of the sample proportion, p-hat, of "yes" responses?

A: The standard deviation of the sampling distribution will be 9 times smaller with sample size 100.

B: The standard deviation of the sampling distribution will be 9 times larger with sample size 100.

C: The standard deviation of the sampling distribution will be 3 times smaller with sample size 100.

D: The standard deviation of the sampling distribution will be 3 times larger with sample size 100.

E: The standard deviation of the sampling distribution will be the same for both sample sizes.

Feedback

A : 0

This is not quite right. Remember that we expect the standard deviation of the sampling distribution of p-hat to decrease as the sample size increases. Consider the remaining options. (D) is the right answer.

B : 0

This is not quite right. Although we expect the standard deviation of the sampling distribution of p-hat to be larger with sample size 100 as compared to that with sample size 900, remember that the standard deviation of the sampling distribution of p-hat contains the term 1 n and the rest does not depend on sample size. Consider the remaining options. (D) is the right answer.

C : 0

This is not quite right. Remember that we expect the standard deviation of the sampling distribution of p-hat to decrease as the sample size increases. Consider the remaining options. (D) is the right answer.

D : 10

Good job! For a sample size of 100, the sampling distribution of p-hat is: p (1 − p) 100 . For a sample of size 900, the sampling distribution of p-hat is: p (1 − p) 900 . This is the correct answer since: p (1 − p) 900 = p (1 − p) 9 ∗ 100 = 1 3 p (1 − p) 100 .

E : 0

This is not quite right. Remember that we expect the standard deviation of the sampling distribution of p-hat to decrease as the sample size increases. Consider the remaining options. (D) is the right answer.

Question (5)

The sampling distribution of a statistic is (select the best answer):

A: The mechanism that determines whether the random sampling was effective.

B: A ***normal*** curve, for which probabilities are obtained by standardizing.

C: A distribution of all parameters from the population that is to be randomly sampled.

D: A distribution of a single statistic from repeated random samples of the same size, from the same population.

E: A distribution of all possible summary statistics from a single random sample, from the same population.

Feedback

A : 0

✗ This is not quite right. The sampling distribution is not able to determine whether random sampling was effective or not, because you do not know the population parameters beforehand, otherwise you wouldnâ€™t need sampling. Consider the remaining options. (D) is the right answer.

B : 0

✗ This is not quite right. This statement is far too general to be correct. It refers to all normal distributions, not just the sampling distribution. Consider the remaining options. (D) is the right answer.

C : 0

✗ This is not quite right. (D) is the right answer.

D : 10

✓ Good job! This is simply the explanation of what the sampling distribution of a statistic is. None of the others are correct.

E : 0

✗ This is not quite right. (D) is the right answer.

Question (6)

Suppose that 20% of the residents in a certain state support an increase in the property tax. An opinion poll will randomly sample 400 state residents and will then compute the proportion in the sample that support a property tax increase.

How likely is the resulting sample proportion to be within .04 of the true proportion (i.e., between .16 and .24)?

(***Hint***: Use the sampling distribution of the sample proportion in this case.)

A: It is ***certain*** that the resulting sample proportion will be within .04 of the true proportion.
B: There is roughly a 99.7% chance that the resulting sample proportion will be within .04 of the true proportion.
C: There is roughly a 95% chance that the resulting sample proportion will be within .04 of the true proportion.
D: There is roughly a 68% chance that the resulting sample proportion will be within .04 of the true proportion.

Feedback

A : 0

✗ This is not quite right. You want to find $P (.16 < p \hat{} < .24) = P (.16 - .20\ \sigma\ p \hat{} < Z < .24 - .20\ \sigma\ p \hat{})$. Using what you know about the mean and standard deviation of a sampling distribution, you should be able to find the given probability. Consider the remaining options. (C) is the right answer.

B : 0

✗ This is not quite right. It seems that you have found the probability that p-hat lies between .14 and .26 rather than the probability that p-hat lies between .16 and .24. Consider the remaining options. (C) is the right answer.

C : 10

✓ Good job! Here we are given that in the population (residents of a certain state) the proportion of those who support tax increase is p = .20. From this population we draw a random sample of size n = 400, and we want to know the likelihood that the proportion of those who support tax increase in the sample (p-hat) will be between .16 and .24. As the hint suggests, in order to answer this question, we need to consider the sampling distribution of p-hat, which is normal (mean = p = .20, standard deviation = $p (1 - p)\ n = .20 (1 - .20)\ 400 = .02$. Given this information, to find the likelihood that the sample proportion of p-hat is between .16 and .24, we can proceed in two ways. First, we can notice that .16 is exactly 2 standard deviations below the mean and that .24 is exactly 2 standard deviation above the mean, and so according to the standard deviation rule, the likelihood is approximately 95%. Second, we can do this more formally. The z-score of .16 is -2 and the z-score of .24 is +2. Therefore, $P(.16 < \hat{p} < .24) = P(-2 < Z < 2) = P(Z < 2) - P(Z < -2)$.

D : 0

This is not quite right. It seems that you have computed the probability that p-hat is between .18 and .22 rather than the probability that p-hat is between .16 and .24. Consider the remaining options. (C) is the right answer.